

6C.5A HOW TO USE NATURE-BASED SOLUTIONS IN URBAN PLANNING SYSTEMS OF EUROPE?

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1. INTRODUCTION

In developed countries, the level of urbanization is still rising and expected to reach 83% in 2030 [United Nations, 2012]. As a result of rapid growth of urban areas and population, the urban planners face several challenges. For example, risks of flooding due to overload of the drainage system, and pollution due to combined sewer overflows and diffuse pollution, consequently increase significantly. Questions about biodiversity promotion and urban heat islands are also emerging as major issues in the construction of sustainable cities [Berretta et al; 2014].

European Commission, [2015] highlighted nature-based solutions in order to address the mentioned urban problems related to climatic, demographic and technological changes. The aim is to bring new solutions into urban planning and thus, to address those challenges and to improve the well-being sensation, quality of life of city dwellers.

Nature-based solutions (NBS) are one of the newest concepts for tackling urban challenges. The concept of NBS was meant to reform the methodology of urban planning in EU countries and deliver multiple environmental, social and economic benefits through introducing and implementing a new toolkit based on natural resources. The concept of NBS can be characterized as the use of nature in tackling challenges such as climate change, food security, water resources,

or disaster risk management, encompassing a wider definition of how to conserve and use biodiversity in a sustainable manner [Balian et al., 2014]. In urban landscapes, the co-benefits of NBS are being increasingly recognized as a result of increased provisioning and improved availability of urban green spaces. Such benefits include, for example, improved quality of life, mental and physical health, and reinforced cultural identities, supporting a sense of belonging and place [Keniger et al. 2013, Hartig et al. 2014].

2. NATURE-BASED SOLUTIONS AND URBAN PLANNING

In the Horizon 2020 project, Nature4Cities besides multi-thematic and multi-scalar evaluation of nature-based solutions and their effectiveness in addressing different urban challenges we aim to deliver a platform used by urban planners. As a first step of the research, which is described in this paper, we analyse the possibilities of implementing nature-based solutions in the different planning systems of Europe. First, we give a short overview on similarities and differences between planning systems, and the different kind of plans (master plans, action plans, authorization plans, etc.) Secondly, we describe Nature4Cities concept on NBS-typology, and thirdly we analyse the possibilities of inserting the particular nature-based solutions into the different kind of plans in different scales.

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2.1 DEFINITION OF NATURE-BASED SOLUTIONS

In Nature4Cities we took European Commissions definition as a basis, however, some modifications were made to adapt this definition to the urban context and render it more operational. Thus, the definition which we use in the project is the following: "Nature-based solutions are positive responses to social challenges, and can have the potential to simultaneously meet environmental, social and economic objectives. They recognize the importance to develop a systemic approach and at the same time to adapt interventions to the local context. They also integrate the temporal factor to meet the challenge of durability.

They are actions inspired by, supported by or copied from nature. Such solutions bring more, and more diverse, nature and natural features and processes into cities. They are living solutions, and as much as possible they take part in complex and functional ecosystems (Note that GMO, and other solutions that artificially alter nature are excluded.)

Nature-based solutions use the features and complex system processes of nature. By using the natural flows of matters and energy, these are low-input solutions. If these solutions are conceived and implemented in a proper way, low-maintenance, cost savings, energy and resource efficiency are expected. NBS also benefit from the malleability of nature (capacity to evolve and to adapt) and are thus more resilient to changes.

They both use and enhance existing solutions to challenges, as well as explore more novel solutions." [Cerema et al, 2018]

2.2 CATEGORIZATION AND SCALES OF NATURE-BASED SOLUTIONS

In Nature4Cities 75 types of NBS were listed, which are classified according to a systemic approach. In this paper, we concentrate only on those NBSs which can demonstrate their role in urban planning projects. These NBSs are the following:

- ensuring continuity of ecological networks
- limit or prevent access to area or specific uses
- planning tools to control territorial expansion
- green waterfront
- phytoremediation
- keeping old trees
- erosion control
- de-sealed areas
- large green spaces
- greening open spaces
- community gardens
- botanical gardens
- cemeteries
- street tree lines
- green tram tracks
- swales
- green façade and wall
- green roof

The listed NBSs are categorized according to their impact on social urban challenges. These are rather important from urban planning point of view, as some of the NBSs might act similarly in plans or might have similar social effects. Therefore it makes easier to understand their impact mechanism and role in urban planning if we can handle them in categories. Categorization enables us to show the different scenarios of implementation based on scale and urban planning tool.

The concept of nature-based solutions is a rather new concept, and we can state, that the implementation of EU policies depends greatly on the planning system of the particular country. That is, the type of plans, which are usually strictly regulated, and thus, the tools, which can be used in the plans too. Introducing shortly the four existing planning approaches in Europe. This categorization is shown in Table I.

Table. 1 Classes of NBS based on their impact on urban planning issues

NBS type	NBS class
ensuring continuity of ecological networks	Strategic elements
limit or prevent access to area or specific uses	
planning tools to control territorial expansion	
green waterfront	
phytoremediation	restoration of green areas / urban rehabilitation / and management techniques
keeping old trees	
erosion control	
de-sealed areas	
large green spaces	„patchwork“-like interventions, green space with intensive use
greening open spaces	
community gardens	
botanical gardens	
cemeteries	linear interventions
street tree lines	
green tram tracks	
swales	
green façade and wall	point-like interventions
green roof	

The scale of the nature-based interventions can be multiple. We identified three scales of NBS interventions taking into consideration the practice of urban planning: city, neighbourhood and object.

City scale should consider the agglomeration of the city, but most of the cases urban planning tools can deal with the territory within the administrative boundaries of the city. [Halbert, 2006, Williams et al, 2016] which usually leads to inconsistency between planning scales and urban challenges.

Neighbourhood scale is defined as a section of a city defined by the distinguishing character of urban fabric or a certain administrative division. Neighbourhood scale seems to have the biggest potential in NBS implementation, however numerous aspects need to be investigated and complex expertise is needed for decision making.

Object scale refers the scale of a building plot: that is a building or an open space with dimensions of some hundred meters with local characteristics. [Barbano et al.,2015].

3. URBAN PLANNING SYSTEMS OF EUROPE

In Europe during a long history of urban planning and according to the different history, culture and economic and social development of the countries, we can distinguish four different planning traditions according to literature [Thornley and Newmann, 2002; Williams, 2018; CEC², 1997]. Figure 1 shows the connections between them, and the countries, for which they are most characteristic.

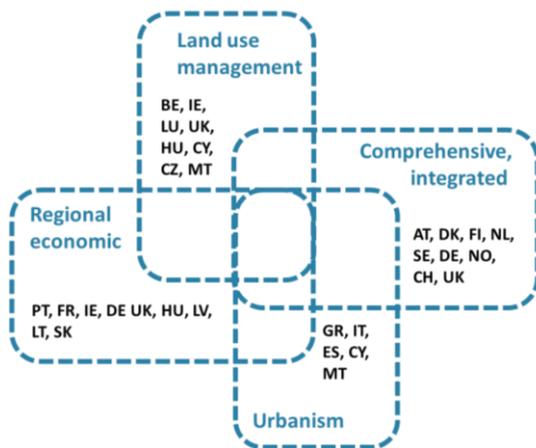


Figure 1. The four planning traditions of Europe. [Salamin, 2018]

The four planning traditions have originated from certain countries, however, during a European integration of planning systems, they might have spread wide and a country's planning system is surely influenced by more than one approach.

- Regional economic planning focuses on the management of economic and social inequalities with development and infrastructure programs. This planning tradition has originated from France, however it influenced numerous countries' urban planning system, such as: Portugal, Ireland, UK, Latvia and Lithuania.

- Land use management "tradition" puts emphasis on the regulation of land-use change with strategic and local plans. This approach focuses on the management of physical space by applying the urban planning tools as regulations. Most characteristic to the planning of the British Isles (UK, Ireland), it has affected Cyprus and Malta (former British protectorates) and other countries too.

- The comprehensive integrated planning approach, which is mainly related to the Dutch tradition, involves the various tools of space-shaping, the coordination of the various actors in the development of spaces. Focusing on the spatial effects of policies and the coordination of actors and sectors, vertical and horizontal coordination is highly important.

- Urbanism is rooted in the action of urban construction, and primarily targets the control of construction itself. The tradition of urbanism conditions urban design, cityscape and construction with zones and regulations. [Salamin, 2018]

After listing the differences between planning systems, here we list some important common features of urban planning and the relevance in implementing NBS.

City or metropolitan scale:

Master planning is a tool widely used around Europe, and is a highly relevant tool for NBS planning too. A good example to demonstrate the importance of master planning in city or metropolitan scale NBSs, is the so-called Finger plan of Copenhagen. [Vejre et al, 2007]. The Finger plan was established in 1947 [Cervero, 1998], and aimed mainly to manage a mass of commuters in the area and providing suitable places for industrial and commercial activities. The master plan affects today above 30 municipalities of the metropolitan area of Copenhagen. The importance of the Finger plan in green space network development is, that the plan as designated the areas between the "fingers" as green spaces, preserving them from urban sprawl, and creating well-defined green corridors around the city. The finger plan concept was adapted by Helsinki and Stockholm too. A similar approach is represented in Abercrombie's Greater London Plan (1944) establishing

² Commission of the European Communities

a green belt around the city for controlling urban expansion. [Roosmalen, 1997].

Neighbourhood scale:

Neighbourhood planning is an important element of British and Irish planning system, however, it is often used in urban rehabilitation all around Europe too. [Bukowski, Füzér, 2007]. Neighbourhood scale interventions are also beneficial for being an appropriate scale for participatory planning. Public engagement can be conducted on several levels, and NBS is usually a highly popular topic [Frantzeskaki and Kabisch, 2016] A good example is two rehabilitation projects in Budapest's 8th District, Józsefváros, where local residents have been involved in planning and planting greenery in open spaces (Mátyás tér, Magdolna Negyed, Teleki tér). According to literature [Alföldi, Kovács, 2007] public security has increased in the area, and economic uptake has been detected after the implementation of the projects.

Object scale:

The implementation of NBS on object scale can be discussed either investigating natural interventions on buildings or on open space projects. Investigating the urban fabric, green open spaces have certainly a potential in mitigating urban heat island effects on microscale [Szkordilis, 2014]. However, due to the multiple criteria that arise during the planning, it might be difficult to implement NBS making full advantage of its benefits. Visible transparency, public safety and easy management are usually the key considerations when refurbishing an open space. Most important is the implementation of NBSs such as keeping old trees (not only while planning but throughout the construction period too), using soft and natural solutions to keep management needs low: for example: phytoremediation, mulching, and preferring unsealed surfaces to sealed ones.

On the other hand, the use of nature-based solutions near buildings also depend on the function, the orientation, solar exposure, and envelope. Implementation of NBS might be of significance on public buildings. However, due to economic factors, investors are highly motivated to implement nature-based solutions in buildings, if economic benefits are foreseen. Numerous studies have shown [Luay et al, 2016], that office buildings with green labelling (EnergyStar, LEED) realize a higher prize (selling or renting) on the real estate market. Therefore, investors are directly interested in investing in the implementation of nature-based solutions, that will enhance the well-being of those using the building.

After introducing the scales, we list the most commonly used planning tools to be used in urban planning throughout Europe. Usually, spatial scale and the timeframe of the plan are connected, larger scale plans tend to influence long-term (country or county land use plans), and smaller scale plans (rehabilitation plan,

action plan etc.) refer to neighbourhood scale and for short-term interventions. Not only plans, but long- and mid-term development strategies might also influence the implementation of NBS. Also, there are some countries (Ireland, United Kingdom, and Hungary) using so-called design manuals, that also make suggestions on the planting of vegetation around the building itself. [Shay Scanlon, 2009]. Table 2. summarizes the different type planning tools in a non-exhaustive list.

Table 2. Common planning tools and their scale of intervention.

planning tool	scale of intervention
county / regional land-use-plan	regional / city
county / regional development plan	
integrated urban development strategy	
urban land-use-plan, local building code	
urban rehabilitation plan	city / neighbourhood / object
action plan	
feasibility study	neighbourhood
green infrastructure development concept	
planning guides and design manuals (UK, IE, HU)	
urban rehabilitation plan; landscape architecture plans	neighbourhood
national urban planning and building requirements;	object
local building code;	
architectural plans	

4. NBS and GOVERNANCE

Governance and implementation of NBS, and similar innovative actions, requires both support of the local public that is expressed through the activities of the attitudes and concepts of the policy-makers, especially of the mayor, and the incentives from higher level of the state administration. Besides the standpoint shared about the positive effects of certain policies and programmes, long-term support and longevity of the initiative require also the positive financial outcome, at least in the mid-term, preferably without subsidies vulnerable to political and personal changes.

Holistic, multidimensional approach is a must in creating and implementing effective strategies and plans successful in the long run. Such methods are mostly in essence incompatible with the workings and logic of local administration, despite the countless opposite

personal efforts on all levels of the system. The configuration of the local administrations favours one-dimensional approaches strictly limited to one professional field as their structure is based on bodies and agencies separated functionally along the above-mentioned lines. Such split is further reinforced by mutually illegible professional jargons underpinning clandestinely the exclusive and indisputable importance of the given discipline and organisational body representing it.

Integrated efforts and strategies thus call for sustained and explicit endorsement of local stakeholders, support of the local political élite, especially the mayor, and supporting stance of upper administrative and political bodies.

Involvement of the locals may offer a firm foundation for such actions, although the practice of public participation may seem laborious, lengthy, hazardous and purportedly unprofessional, particularly to the above mentioned municipal and other expert branches.

Researches show that primarily financial aid programmes and subsidy schemes have often detrimental effects on the long-term commitment of local agents and bodies. As a matter of fact, they seem to foster short-term spending depletion of available

resources and lead negligence and resistance in the long run. This is especially the case when either local commitment is lacking, or financial sustainability and maintenance is highly dubious.

5. SUMMARY

Summing up the research done so far, it seems, that the implementation of NBS is not different of other, upcoming and innovative ideas in urban planning. As showed, both on the side of urban planning and governance the process of implementing NBS needs a complex and multi-scale approach, which is not easy to achieve. However, the concept of NBS can be made attractive to the decision-makers, if economic benefits and wide social acceptance is obviously presented. For this purpose, the Nature4Cities platform will be implemented, to spread the concept among wide public, decision-makers and experts.

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REFERENCES

Alföldi György, Kovács Zoltán (editors.), 2007: *Városi zöld könyv, Kulcs a fenntartható városhoz*; Budapest: ÉTK; MTA FKI; Rév8 Zrt, 2007. 195 p.

Balian, E., H. Eggermont, and X. Le Roux. 2014. Outcomes of the strategic foresight workshop. BiodivERsA Strategic Foresight workshop, Nature-based solutions in a *BiodivERsA context*. Brussels June 11-12.

Barbabo, Julia; Egusquiza, Aitziber (2015): Interconnection between Scales for Friendly and Affordable Sustainable Urban Districts Retrofitting, *Energy Procedia* 78 (2015) 1853 – 1858

Berretta, C.; Poë, S. & Stovin, V., 2014: Moisture content behaviour in extensive green roofs during dry periods: The influence of vegetation and substrate characteristics, *Journal of Hydrology* 511 : 374 - 386.

Bukowski, A. and Füzér K: Problems and barriers in urban rehabilitation policy co-ordination across cities and regions of Europe, 2007, in: *Urban Rehabilitation in Segregated Districts of Central and Eastern European Cities: Studying Social Exclusion and Developing Urban Policy*. 11-26. Edited by. Andrzej Bukowski, Katalin Füzér, Barbara Jabłońska, Marta Smagacz. Krakko: RABID.

Cerema, MUTK, Ekodenge, LIST, Green4Cities, Acciona, Cartif, Agrocampus Ouest, Szeged University, Nobatek, Plante et Cité, 2018, *D1.1 – NBS multi-scalar and multi-thematic typology and associated database*, Nature4Cities H2020 Project Deliverable

Cervero, Robert, 1998: *The Transit Metropolis: A Global Inquiry*. Washington: Island Press., pp 136-146

Commission of the European Communities, 1997: *The EU Compendium of Spatial Planning Systems and Policies*. Luxembourg: Office for Official Publications of the European Communities.

European Commission, 2015: *Towards an EU research and innovation policy agenda for nature-based solutions & re-naturing cities. (No. Final report of the Horizon 2020 expert group on "Nature-based solutions and re-naturing cities.")*. Brussels.

Hartig, T., R. Mitchell, S. de Vries, and H. Frumkin. 2014. Nature and health. *Annual Review of Public Health*, 35:207-228.

Kabisch, N., Frantzeskaki, N., Pauleit, S., Naumann, S., Davis, M., Artmann, M., Haase, D., Knapp, S., Korn, H., Stadler, J. and Zaunberger, K., 2016. Nature-based solutions to climate change mitigation and adaptation in urban areas: perspectives

on indicators, knowledge gaps, barriers, and opportunities for action. *Ecology and Society*, 21(2).

Keniger, L. E., K. J. Gaston, K. N. Irvine, and R. A. Fuller. 2013. What are the benefits of interacting with nature? *International Journal of Environmental Research and Public Health*, 10 (3):913-935

Luay N. Dwaikat, Kherun N. Ali, 2016: *Green buildings cost premium: A review of empirical evidence*, Energy and Buildings, Vol 110, pp 396-403.

Martinez-Fernandez, C., Audirac, I., Fol, S., & Cunningham-Sabot, E. 2012: Shrinking cities: Urban challenges of globalization. *International Journal of Urban and Regional Research*, 36(2), 213-225.

Raymond, C. M., Frantzeskaki, N., Kabisch, N., Berry, P., Breil, M., Nita, M. R., ... & Calfapietra, C. 2017: A framework for assessing and implementing the co-benefits of nature-based solutions in urban areas. *Environmental Science & Policy*, 77, 15-24.

Roosmalen, P. van, 1997: London 1944: Greater London Plan, in: K. Bosma, H. Hellinga (eds.), *Mastering the City: North-European Town Planning 1900-2000*, NAI Publishers/EFL Publications, Rotterdam, pp. 258-265

Salamin, Géza (2018): *A földrajzi tér alakításának európaizálódása: Az Európai Unió térbeli stratégiáinak, tervezésének és kohéziós politikájának hatása az európai országok térbeli tervezési rendszereinek transzformációjára (Europeanization of Shaping Geographic Space: The influence of the European Union's spatial planning, strategies, and Cohesion Policy on the transformation of the spatial planning systems of European countries)*. (PhD thesis) 199 p. Szent István Egyetem, Gödöllő

Shay Scanlon, Shay Scanlon Architects, and Planning Dept., Meath County Council: *Meath Rural House Design Guide*, Meath County Council, December 2009

Szkordilis, Flóra (2014): *Mitigation of urban heat island by green spaces*, POLLACK PERIODICA: An International Journal For Engineering And Information Sciences 9:(1) pp. 91-100.

Thornley, A. and Newman, P., 2002. Urban planning in Europe: International competition, national systems and planning projects. *Routledge*.

United Nations, 2012: Department of Economic and Social Affairs, Population Division: World.

Vejre, Henrik; Primdahl, Jørgen; Brandt, Jesper, 2007: The Copenhagen finger plan: keeping a green space structure by a simple planning metaphor. In: *Europe's living landscapes: essays exploring our*

identity in the countryside. ed. By: Bas Pedroli; Anne van Doorn; Geert de Blust; Maria Luisa Paracchini; Dirk Wascher; Freda Bunce. Holland, KNNV Publishing, p. 311-328.

West, P. J., and Berman E. M., 1997, Administrative Creativity in Local Government, *Public Productivity & Management Review*, Vol. 20, No. 4, pp. 446-458

Williams, R.H. ed., 2018. Planning in Europe: Urban and regional planning in the EEC (Vol. 22). *Routledge*.

Luay N. Dwaikat, Kherun N. Ali, 2016: *Green buildings cost premium: A review of empirical evidence*, Energy and Buildings, Vol 110, pp 396-403.